FLIGHT SIMULATION THROUGH MENTAL PRACTICE

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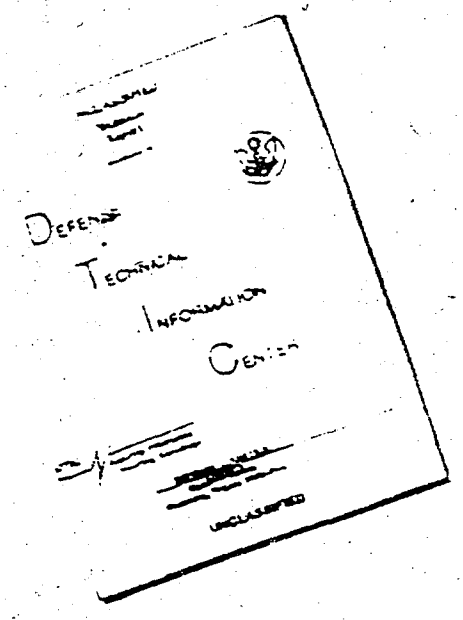

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13. ABSTRACT

This experiment demonstrates that the use of mental practice may be an effective adjunct to any training program which normally depends completely on costly actual practice of the skill being learned. Twenty-three Ss were randomly placed in one of two groups. All Ss were student pilots and minimally experienced in the landing of the T-37 aircraft, the independent variable and skill to be learned. The experimental group (E) listened to four 12½-minute tape recordings which prompted their mental practice of landing the T-37 aircraft. The control group (C) did not receive this practice. All Ss were rated by their instructor pilots on procedures and ability to land the aircraft on the training flight following the last mental practice session. Group E's ratings on both procedures and ability to land were significantly higher ($p < .05$) than the ratings of Group C.

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by

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ABSTRACT

This experiment demonstrates that the use of mental practice may be an effective adjunct to any training program which normally depends completely on costly actual practice of the skill being learned. Twenty-three Ss were randomly placed in one of two groups. All Ss were student pilots and minimally experienced in the landing of the T-37 aircraft, the independent variable and skill to be learned. The experimental group (E) listened to four 12½-minute tape recordings which prompted their mental practice of landing the T-37 aircraft. The control group (C) did not receive this practice. All Ss were rated by their instructor pilots on procedures and ability to land the aircraft on the training flight following the last mental practice session. Group E's ratings on both procedures and ability to land were significantly higher ($p < .05$) than the ratings of Group C.

I. INTRODUCTION

With the rising cost of simulation devices, it is important to evaluate other devices and techniques that may be able to improve performance in a perceptual-motor skill. Mental practice of a skill is where the S attempts to vividly imagine the perceptual-motor actions involved in practicing the skill. Davis and Wallis (1961) have found that regular mental practice is superior to irregular actual practice in motor skill learning. Twining (1949) found no significant differences between actual and mental practice on basketball foul shooting. Shick (1970) was able to improve a volleyball skill through mental practice. Blurton (1969) used behavior therapy with imagery to significantly improve field goal shooting in practice, but found no significant differences in actual game situations. It appears that mental imagery can, in many cases, improve performance of a perceptual-motor skill.

The author, in an unpublished study, attempted to improve the strafing ability of student fighter pilots through mental practice. He found that mental practice of this skill did improve actual strafing scores over those of pilots who did not use the mental practice technique. Due to loss of control over the experimental subjects, statistical analysis was impossible.

Corbin (1967) found that some previous experience with the skill is necessary for mental practice to be effective. It was decided that landing an aircraft by minimally experienced student pilots would be

a skill in which the Ss had some experience, yet is a highly complex perceptual-motor skill of the type that would be important to investigate. If this skill could be improved by mental practice, then it would strongly suggest that many less complex human skills may also be improved by this technique. This experiment was pointed toward improving performance in flight training in the United States Air Force. The Ss had some experience in landing an aircraft, but very little in landing the particular aircraft that was the independent variable. Due to the problems the author had encountered in the control of the Ss in his pilot study, he decided to use tape recordings as a prompt to the mental practice. This allowed for an exact timing of the student mental practice and a more precise control of his mental imagery. By weighing the student time and the cost of the apparatus, the cost effectiveness of such a program could be compared to more sophisticated methods of simulation.

The question proposed in this research was whether four highly prompted mental practice sessions, of approximately 12½ minutes each, could improve the student pilot's performance on landing an aircraft.

II. METHOD

Subjects

The subjects were 23 randomly selected student pilots in the undergraduate T-37 pilot training program at Williams Air Force Base. Thirteen were in the experimental group (E) and ten were randomly placed in the control group (C). All Ss were low experienced student

pilots with approximately 20 hours in the T-41 trainer and 4 hours in the T-37.

Apparatus

The experimental sessions for the E Ss were conducted in the learning center at Williams AFB. This center has typical student learning carrels for individual instruction through media presentation. The E Ss sat in a cockpit procedures trainer of the T-37 aircraft. This cockpit mock-up was configured similar to the actual aircraft through photographs. The only movable items in this mock-up were the throttles and the control stick. The instructions and stimulus information were played over a dial access tape recording and through earphones to the student.

Procedure

The E Ss had observed and attempted the experimental task, that of landing the T-37 aircraft; but this experience was at a low level consisting of approximately 7 previous landings. The E Ss were instructed to go to the learning center after they had completed the fourth, fifth, sixth, and seventh mission in the flying training syllabus and listen to a tape recording while sitting in the cockpit mock-up.

The tapes were designed to give instruction in the landing pattern. The E Ss were told to imagine the situations as vividly as possible and to perform the same motor actions and eye movements that they would if they were in the actual landing pattern. In the first few imagined landing sequences the E Ss were given complete

instructions on tape as to the airspeeds, throttle settings, pitch attitudes, bank required, etc. In the later imagined patterns these cues were withdrawn until in the last few sequences the tapes merely stated "You are on base" or "You are on final." To vary the sequences slightly, error analysis, go-arounds, touch-and-go, and final full-stop landings were all covered in this experimental training. The running time for each tape, in order, was 11:50, 15:10, 11:20, and 10:45.

The C Ss were not given any of the above experimental training. These C Ss received the normal training that past student pilots have received, which included some media presentations in the learning center.

After the eighth actual flying mission both the E and C Ss were rated by their own instructor pilots on their performance as to technique and procedures in the landing pattern on that particular mission. This was a relative rating of the student's performance on several areas in the landing pattern. The instructor pilots did not know which students were in which group. Several instructor pilots had a student in each group to rate.

III. RESULTS

Instructor Ratings

The Ss' instructor pilots filled out a one-to-seven rating scale on techniques and procedures for the following phases of the landing pattern: initial to pitch, pitch to downwind, downwind to final, final

to flare, flare to touchdown, and go-around. The ratings for these phases of the landing pattern were averaged for each of the technique and procedure areas to give a more meaningful, stable rating. The procedure area was defined as how well the student knew what to do, and the technique area was defined as how well he actually accomplished the landing task. The rating was relative in that the instructor was told to rate the S in relation to all the other students he had instructed on that particular mission.

Mann-Whitney U. Analysis

The results were analyzed by means of the Mann-Whitney U. test. On procedures, the E group had a mean rating of 4.53 and the C group 4.26 ($U = 35.3$, $p < .05$, two-tailed). On techniques, the E group had a mean rating of 4.21 and the C group 3.89 ($U = 38.0$, $p < .05$, two-tailed).

IV. DISCUSSION

From the results of this experiment it appears that mental practice combined with actual practice is more effective than just actual practice when learning a perceptual-motor skill. The tape recorded presentation, using graduated withdrawal of prompts to help control the mental imagery, is probably more effective than just letting the student imagine the skill without structure. Further structure was added to the mental practice by having the S sit in the cockpit mock-up of the aircraft he was flying. With the extra practice gained by using prompts, it might be expected that the mental practice would improve

the procedures of the S; but the finding that the actual performance was improved through transfer of the skill practiced in the mental imagery sessions is very significant.

All E Ss filled out a critique on the program. Without exception they felt the mental practice helped them to perform better while flying. Most of the E Ss stated that they did not have any problem in vividly imagining the situations called for by the tape recordings.

Because the independent variable involved in this experiment is a highly complex perceptual-motor skill, the results can probably be extended to include many areas of skill learning. The use of mental practice may be an effective, low-cost adjunct to any training program which normally depends upon costly actual practice of the skill being learned.

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